

49. *The Discovery of Olenus in South Chosen**.

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Recently I¹⁾ have demonstrated that the faunas of South Chosen and Central China were linked by *Hedinia*, *Lopnorites* and *Charchaquia* with that of Tienshan on the one side and with that of Central Australia on the other side at the time of transition from the early Upper Cambrian to the late Middle Cambrian period. But no evidence of connection between Eastern Asia and Europe has ever been found.

Needless to say, a discovery of *Olenus* or some other typical member of the Olenidae in any Cambrian formation in Asia is of extraordinary value for the stratigraphy and palaeogeography of the Eurasian continent. This is because the Upper Cambrian formation in the Atlantic province contains olenids so abundantly that it is called Olenidian and zoned by means of the trilobites of the Olenidae. For this reason I once carried on a search for true olenids through all the literature on the Cambrian trilobites in Asia, but my efforts were in vain. As a result of that study, however, it was ascertained that *Olenus* (?) *indicus* Waagen and *Olenus* (?) *haimantensis* Reed from the Himalaya were respectively a solenopleurid and a ptychoparid. When I³⁾ made a re-study on Lorenz's collection of Cambrian fossils from Shantung at the Geol. Inst. at Freiburg i. Br. through the courtesy of Prof. W. Soergel, it was found that his *Olenus* sp. is nothing but a pygidium of either *Maladioides* or *Changshania*.

My unceasing search was at length rewarded by a fortunate strike of my hammer when a specimen of *Olenus* was yielded, at the time of my visit to the Neietsu district in South Chosen in 1939 to supervise Yosimura's field-survey. In the ensuing field-work he⁴⁾ collected some more specimens of this faunule. A few more were later found by Hukasawa⁵⁾ during his survey in the Heisho district.

As a result of a palaeontological study made on the whole collection from the upper part of the Machari formation it is found that one

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1) T. Kobayashi (1944), A Proof of Cambrian Sea-Connection between South Chosen and Eastern Tienshan. *Proc.* **20** (1944), 100.

2) — (1936), On the *Parabolinella* Fauna from Province Jujuy with a Note on the Olenidae. *Japan. Geol. Jour. Geogr.* vol. 13.

3) — (1938), Restudy on Lorenz's Types of the Cambrian Trilobites from Shantung. *Jour. Geol. Soc. Japan.* vol. 45.

4) I. Yosimura (1940), Geology of the Neietsu District, Kogendo, Tyosen. *Jour. Geol. Soc. Japan.* vol. 47.

5) T. Hukasawa (1943), Geology of Heisho District, Kogendo, Tyosen. *Jour. Geol. Soc. Japan.* vol. 50.

species belongs undoubtedly to *Olenus* s. str. and is closely allied to certain species of the genus. Furthermore it occurs together with *Glyptagnostus* which is another important horizon marker¹⁾. Because the two genera are restricted in their occurrence to the *Olenus* zone, the view is quite warranted that this fossil horizon of the Machari formation is the correlative of the *Olenus* zone in the succession of Sweden²⁾ on the Atlantic side.

The occurrence of the two genera are, however, exceedingly rare outside of the Atlantic province. In fact they are known from only four localities which are, curious enough, isolated spots in the world, namely, one in northeastern Australia, another in British Columbia, still another in Alabama, and finally a new locality is found in Chosen. All of these localities are of small areas. *Olenus* cfr. *truncatus* (Brunnich) was once reported to occur in a green shale at Cedar Bluff in Alabama³⁾, but when I made a careful comparison I found it to be distinct from *Olenus* while it bore some characteristics indicating that it is related to *Aulacopleura*. I⁴⁾ have therefore given it a new name, *Proaulacopleura buttsi*. The *Proaulacopleura* horizon can however be correlated with the *Olenus* one on the basis of *Glyptagnostus angelini* Resser⁵⁾ which occurs together.

A trilobite collected by Evans⁶⁾ in a black limestone of Mt. Jubilee, west of Harrogate, British Columbia, was tentatively called *Olenus* sp. by Resser. It was, however, not a true *Olenus* but a new species of *Parabolinella* to which I gave a new name, *P. evansi*, in honour of the finder. It forms one faunule together with *Obolus* (?) sp., *Pseudagnostus latus* Kobayashi, *Homagnostus acutus* Kobayashi and *Dunderbergia canadensis* Kobayashi. At an adjacent point in the same limestone *Glyptagnostus* "*reticulatus*" was found by Evans with *Obolus* sp., *Acrotreta* cfr. *idahoensis* Walcott, *Aagnostus inexpectans* Kobayashi, *Hardyoides miror* Kobayashi, *Taenicephalus longifrons* Kobayashi and *Jubileia grandifrons* Kobayashi⁷⁾. The stratigraphic relation between the two fossil horizons was unfortunately not determined, although it is known on the Atlantic side that *Parabolinella* occurs in higher horizons than the *Olenus* zone.

In Southeastern Australia *Glyptagnostus toreuma* Whitehouse⁸⁾

1) T. Kobayashi (1939), On the Agnostida, Part. 1. *Jour. Fac. Sci. Imp. Univ. Tokyo*, sect. 2, vol. 5, pt. 5.

2) A. H. Westergård (1922), Sveriges Olenidskiffer. *Sveriges Geologiska Undersökning ser. Ca, N:o 18*.

3) G. I. Adams, C. Butts, L. W. Stephenson and W. Cooke (1926), Geology of Alabama.

4) T. Kobayashi (1936), Op. cit. *Japan Jour. Geol. Geogr.* vol. 13.

5) E. C. Resser (1938), Cambrian System (Restricted) of the Southern Appalachians. *Geol. Soc. Am. Sp. Pap. no. 15*.

6) C. E. Evans (1933), Brisco-Dogtooth Map-Area, British Columbia. *Canada Geol. Surv.*

7) T. Kobayashi (1938), Upper Cambrian Fossils from British Columbia with a Discussion on the isolated Occurrence of the so-called "*Olenus*" Beds of Mt. Jubilee. *Japan. Jour. Geol. Geogr.* vol. 15.

8) F. W. Whitehouse (1936), The Cambrian Faunas of North-Eastern Australia. Pts. 3. *Mem. Queensland Mus.* vol. 11, pt. 1.

marks off the *Glyptagnostus* stage at a locality 16 miles south of Glenormiston homestead where *Pseudagnostus* cfr. *cyclopyge*, *Proceratopyge nectans* and *Olenus* (?) sp. occur beside the agnostid. He¹⁾ correlated this stage with the *Olenus* zone in Europe and placed between the *Eugonocare* stage below and the *Rhodonaspis* stage above, although the succession seems to be not readily determinable stratigraphically.

The same ambiguity still remains in the stratigraphic relation between the *Olenus* zone in the Nietsu-Heisho district and the *Hedinia* horizon in the Bunkei district, the two localities being some 75 kilometres apart. As reported already²⁾, the Yokusen orogenic zone is complicated by imbrication and the Machari facies is found along its axis. The larger part of the formations of the facies consists of black shales and dark gray limestones in frequent alternations which repeat flutings in the Nietsu district. Under this circumstance a laborious work is necessary to determine the relation between the two zones in the field, even when the two is found in the same section.

From a palaeontological standpoint, however, it is quite reasonable to conclude that the *Olenus-Glyptagnostus* zone of Nietsu is almost coeval with the *Olenus* zone of the Atlantic province, *Glyptagnostus* zone of Australia and probably with the *Proaulacopleura* zone of the Southern Appalachians.

Finally it must be noted that *Acrocephalina trisulcata*, a new species, was found contained in a boulder from the *Glyptagnostus* zone, which is closely allied to *A. armata* Troedsson from Tienshan where it was found together with *Hedinia regalis* Troedsson in the lower part at loc. 22.

Olenus asiaticus Kobayashi, new species. (Figures 1a-1b.)

Description.:—Cranidium subtrapezoidal in general outline: glabella moderately convex, very short for *Olenus*, subquadrate, gently tapering forward, slightly elevated above cheeks and well defined by a dorsal furrow which is deep, especially on the lateral sides; the first pair of lateral furrows faint, short and convex forward; the second pair a little longer, fairly distinct and slightly oblique; third pair of furrows deep, quite oblique to the axis, and apparently confluent with each other; occipital furrow also deep and more or less bent forward on the lateral sides; occipital ring narrow but thickened and somewhat elevated in the middle part; eyes relatively large, occupying the middle one-third of the length of the cranidium; ocular ridge nearly straight and extends from points a little behind the lateral extremities of the anterior margin of the glabella, to points a little anterior to the lateral side; fixed cheek broad, gradually elevated toward the eye; preglabella field large; fine lines on it aligned subparallel in front of the glabella but more or less radiating on the lateral sides; frontal

1) F. W. Whitehouse (1936-39), The Cambrian Faunas of North-Eastern Australia Pt. 3. *Mem. Queensland Mus.* vol. 11. pt. 3.

2) T. Kobayashi, I. Yosimura, I. Iwaya and T. Hukasawa (1943), Geologic Structure of the Western Part of the Limestone Plateau in South Kogen-do. *Proc.* 19 (1943), 89.

rim narrow, nearly straight and up-raised; marginal furrow deep; facial sutures anterior to the eyes nearly parallel to each other and diagonal on their posterior side.

The other parts of the carapace are unknown. The following dimensions are measured on the holotype cranium.

Length of the cranium	5.2 mm.
Breadth of the cranium measured through the eyes	6.3 mm.
Breadth of the cranium measured along the occipital margin	9.6 mm.
Length of the glabella	3.4 mm.
Breadth of the glabella	3.1 mm.

Comparison.—Compared to *Parabolina* (fig. 3a) and *Parabolinella* (fig. 4.) the glabella is small and the eyes are quite large in this species. Its anterior facial sutures are not divergent forward as in *Parabolinella* as well as in *Proaulacopleura*. Insofar as the cranium is concerned it is typical of *Olenus*, and especially similar to that of *O. gibbosus* (Wahlenberg)¹⁾ (fig. 2.) which is the type of the genus, but the glabella is shorter and the eyes are located more posteriorly and somewhat larger. On these accounts this species resembles *Proaulacopleura buttsi* Kobayashi²⁾, but in the latter species the cranium is narrower, lateral glabellar furrows are obscure, eye-ridges transversal and the anterior branches of the facial sutures are divergent forwardly.

Formation and Locality.—*Glyptagnostus* zone; Buntokuji and Itahashi (文徳峠, Locs. 241, 板 1.)

Acrocephalina trisulcata Kobayashi, new species. (Figure 5.)

Description.—A. small strongly convex cranium 2.5 mm. long has a long, tuncato-conical glabella which is distinctly elevated above the cheeks and subcarinated along the axis. Its circum-glabellar furrow is deep and stretches the whole length. An anterior lateral furrow is short and transversal; the middle one is longer; the posterior one being longest and quite oblique to the axis. The last two laterals and an occipital furrow are all deep. An occipital ring is proportionally narrow but thickened toward the middle where a median tubercle exists. Eyes are relatively small and opposed to the second lateral lobes of the glabella; a narrow eye-ridge is present. The breadth of a fixed cheek measured through the eye corresponds to about a half of the breadth of the glabella, steeply sloping down laterally. The preglabellar area is convex and steeply inclined forward; a furrow extends diagonally from the lateral end of the frontal furrow of the glabella, the inner side of it more or less swelling up, assuming a median boss. The anterior facial sutures are almost parallel to the axis, the posterior ones being diagonal. The surface is ornamented by fine tubercles.

1) A. H. Westergård (1922), Op. cit. *Sverig. Geol. Undersök. ser. Ca. 18. p. 124, pl. 3, figs. 1-10.*

2) T. Kobayashi (1936), Op. cit. *Japan. Jour. Geol. Geogr., vol. 13, p. 93, pl. 15, fig. 5.*

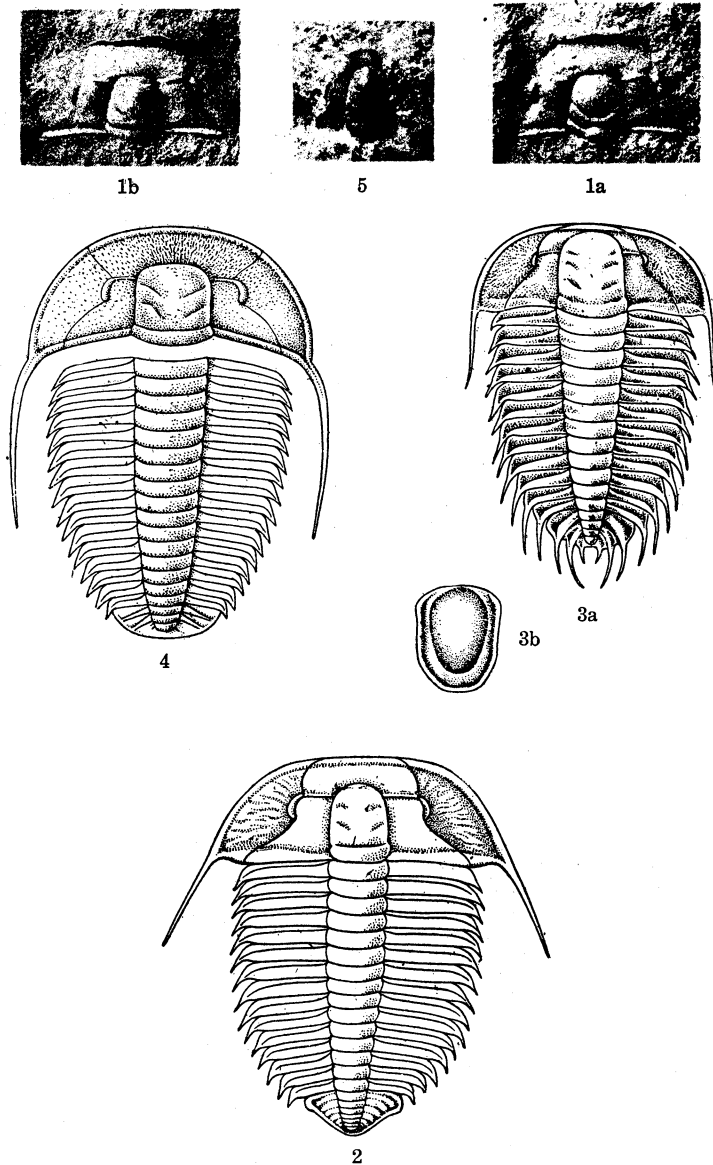


Fig. 1a-b. The internal mould and a cast from the external mould of the holotype cranidium of *Olenus asiaticus* Kobayashi, new species. About three times magnified.

Fig. 2. *Olenus gibbosus* (Wahlenberg) (Restored from pl. 3, fig. 6, and others in Westergård, 1922).

Fig. 3a-b. *Parabolina spinulosa* (Wahlenberg) (Restored from pl. 6, fig. 15 & 18, in Westergård, 1922).

Fig. 4. *Parabolinella argentinensis* Kobayashi (Restored from pl. 15, figs. 1 & 15 in Kobayashi, 1936).

Fig. 5. *Acrocephalina trisulcata* Kobayashi, new species.

Comparison.—Because the median part of the preglabellar area is broken, whether this cranidium has a frontal spine is uncertain. But at any rate it has no occipital spine as seen in *Acrocephalites stenometopus* (Angelin).¹⁾ From *A. vigilans* Walcott and Resser²⁾ it can easily be distinguished by the much narrower outline of its cranidium. In the absence of the frontal border and the presence of the eye-ridge it is certainly closer to *Acrocephalina* than to *Acrocephalites*. Except in the absence of the occipital spine there is no important difference from *Acrocephalina armata* Troedsson³⁾ which is the monotypic species of the genus.

Formation and Locality.—*Glyptagnostus* zone; a boulder in a gully west of Itahashi (loc. 板 1.)

1) A. W. Westergard (1922), Op. cit. *Sverig. Geol. Undersök. ser. Ca. nio. 18, p. 195, pl. 1, figs. 20-21.*

2) C. D. Walcott, and C. E. Resser (1924), Trilobites from the Ozarkian Sandstone of the Island of Novaya Zemlya. *Rep. Sci. Result. Norway. Exped. to Novaya Zemlya, 1921. no. 24, p. 10, pl. 2, figs. 38-40.*

3) G. F. Troedsson (1937), The Sino-Swedish Expedition, Publ. 4, p. 67, pl. 3, figs. 18-19, pl. 4, figs. 12.

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